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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/776,394	02/11/2004	Heung-Jin Joo	5649-1258	3921

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EXAMINER

QUACH, TUAN N

ART UNIT	PAPER NUMBER
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2826

DATE MAILED: 03/11/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

Office Action Summary	Application No. 10/776,394	Applicant(s) JOO ET AL.	
	Examiner Tuan Quach	Art Unit 2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-28 is/are pending in the application.
4a) Of the above claim(s) 1-12 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 13-28 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>2/11/04 & 1/31/05</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-12, drawn to a ferroelectric memory device, classified in class 257, subclass 295.
- II. Claims 13-28, drawn to a method of fabricating a ferroelectric semiconductor device, classified in class 438, subclass 239.

Inventions II and I are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product as claimed can be made by another and materially different process wherein the upper electrode, ferroelectric layer, lower electrode are formed first followed by joining the structure comprising the lower insulating layer including a conductive plug and the oxygen diffusion barrier pattern.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

During a telephone conversation with applicant's attorney D. Randall Ayers on February 22, 2005 a provisional election was made without traverse to prosecute the invention of group II, claims 13-28. Affirmation of this election must be made by applicant in replying to this Office action. Claims 1-12 are withdrawn from further

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consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

Claims 13-18 and 22-25, are rejected under 35 U.S.C. 102(b) as being anticipated by Wang et al.

Wang et al. (6,339,007) teaches forming a ferroelectric memory device comprising a lower insulating layer 21 including an conductive plug 22 on semiconductor substrate 20, forming oxygen diffusion barrier pattern 23 connected to the plug, forming upper insulating layer 26 on the lower insulating layer and surrounding the sidewalls of the oxygen barrier 23 and top surface of the insulating layer 26 is higher than a top surface of the oxygen-barrier pattern, forming a lower electrode layer 28 on the upper insulating layer pattern and the oxygen diffusion barrier pattern, forming a ferroelectric layer 30 on the lower electrode layer, forming an upper electrode layer 31 on the ferroelectric layer 30. See Figs. 1-6 and the substantially similar embodiment in Figs. 8-14, column 3 line 17 to column 4 line 61.

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Regarding claim 14, the provision of a hard mask layer 26 and patterning with the oxygen barrier is also taught, Figs. 3-5, 10-12.

Regarding claims 15-18, the planarization of insulating layer 26 stopping at layer 25 and removal of layer 25 is shown in Figs. 4 and 5, including the use of material including nitrogen such as titanium nitride, column 3 line 56 to column 4 line 12.

Regarding claims 22-24, the materials for electrode including noble metal or metal oxide are taught in Wang et al., column 3 lines 52-57.

Regarding claim 25, the formation of the ferroelectric layer on the entire surface of the lower electrode layer is also shown, e.g., Fig. 13.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al.

Regarding the alternative materials including nitrogen for the hard mask or protective layer such as silicon nitride or titanium aluminum nitride is well within the purview of one skilled in the art to select such conventional materials for such known purpose and as such would have been obvious. Alternatively, official notice is given regarding the selection of such well known alternative materials.

Claims 19, 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. taken with Ochiai et al.

The reference as applied above does not recite the alternative of patterning the upper insulating layer to expose the conductive plug.

Ochiai et al. 6,410,397 teaches forming insulating layer 17 on lower insulating layer 15 having plug 21, patterning the upper insulating layer to form opening exposing the conductive plug. The procedure permits simplified processing wherein lithography procedure may be obviated. See Figs 4A-4C, column 6 line 29 to column 8 line 30.

It would have been obvious to one skilled in the art in practicing the above invention to have formed the opening in the insulating layer since such corresponds to an obvious alternative to form subsequent layers contacting the conductive layer and wherein patterning thereof may be simplified. The provision of the oxygen barrier layer as in claim 20 would have been apparent and obvious where the oxygen barrier if deposited would require patterning.

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Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. taken with Kutsunai et al.

Wang et al. are applied as above and do not enumerate all the various oxygen barrier materials enumerated in these claims. It would have been obvious to one skilled in the art in practicing the above invention to have selected the appropriate oxygen barrier materials including conductive materials as delineated in Wang, column 3 lines 28- 43, including the TiN, TiAlN, etc., and as suggested by Kutsunai et al. 6,590,252, column 3 lines 40-63 including such materials and additional materials such as iridium, ruthenium, osmium as additional barrier on a TiN or TiAlN, including any additional underlayer of titanium to improve adhesion if desired.

Claims 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. taken with Ochiai et al.

In addition to the various materials for electrode delineated above, Ochiai et al., 6,410,397, further evidences the conventional materials for electrodes, column 12 lines 36-44.

It would have been obvious to one skilled in the art to have selected the appropriate materials for the lower and upper electrodes including single layer or multiple layers including noble metal and/or metal oxides as taught by Wang and Ochiai et al. above. Official notice is given additionally regarding any materials enumerated not explicitly recited therein.

Claims 26 and 28 rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. taken with Ochiai et al.

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The same reasons applied above to claims 19 and 20 are applicable here.

Regarding claim 28, the same reasons regarding claims 22-24 are applicable.

Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. taken with Ochiai et al. as applied to claims 26 and 28 above, and further in view of Kutsunai et al.

The same reason delineated above regarding claim 21 are applicable here.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Kim et al., Ito et al., and Evans et al. are made of record.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Quach whose telephone number is (571) 272-1717. The examiner can normally be reached on M - F from 8:30 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor Nathan Flynn can be reached on (571) 272-1915. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (571) 272-1562.



Tuan Quach
Primary Examiner